

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023****Subject Code:3130608****Date:03-08-2023****Subject Name:Mechanics of Solids****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

	<b>Marks</b>
<b>Q.1</b> (a) Explain free body diagram with neat sketch.	<b>03</b>
(b) Write various systems of forces and explain coplanar concurrent force system.	<b>04</b>
(c) Determine magnitude and direction of resultant force of the force system shown in <b>Fig.-1</b> .	<b>07</b>
<b>Q.2</b> (a) Write the assumption made in analysis of truss.	<b>03</b>
(b) Define shear force and bending moment with sign conventions.	<b>04</b>
(c) Determine magnitude, direction and position of resultant force of the force system given in <b>Fig.-2</b> with reference to point A.	<b>07</b>
<b>OR</b>	
(c) Draw shear force and bending moment diagram for the beam shown in <b>Fig.-3</b> .	<b>07</b>
<b>Q.3</b> (a) Differentiate in-between centre of gravity & centroid.	<b>03</b>
(b) Write equation of moment of inertia for rectangular section and triangular section about its neutral axis and base of section.	<b>04</b>
(c) Determine the centroid of the plane area shown in <b>Fig.-4</b> .	<b>07</b>
<b>OR</b>	
<b>Q.3</b> (a) Write assumption made in the theory of torsion.	<b>03</b>
(b) Find out radius of gyration for square section. Consider side dimension is 'B' mm.	<b>04</b>
(c) Find the moment of inertia about both centroidal axes of Z section as shown in <b>Fig.-5</b> .	<b>07</b>
<b>Q.4</b> (a) Write assumptions made in theory of pure bending.	<b>03</b>
(b) Draw shear stress distribution diagram for hollow rectangular, hollow circle and H section.	<b>04</b>
(c) Calculate the diameter of the shaft required to transmit 45 kW at 120 rpm. The maximum torque is likely to exceed the mean by 30% for a maximum permissible shear stress of 55 N/mm <sup>2</sup> . Calculate also the angle of twist for a length of 2 m. $G = 80 \times 10^3 \text{ N/mm}^2$ .	<b>07</b>
<b>OR</b>	
<b>Q.4</b> (a) Define composite beam and give main objectives of it.	<b>03</b>
(b) A simply supported beam 300 mm x 600 mm of 6 m. span is subjected to UDL of 15 kN/m throughout the span. Find the maximum bending stress in the beam.	<b>04</b>
(c) Determine the shear stress at the junction of the flange & web of an 'I' section as shown in <b>Fig.-6</b> . Consider shear force 20 kN.	<b>07</b>
<b>Q.5</b> (a) Define with sketch (i) tensile stress (ii) compressive stress (iii) shear stress	<b>03</b>

- (b) State Hook's law. Explain stress-strain behavior of mild steel with sketch. 04  
 (c) Determine the magnitudes & directions of principal stresses for two dimensional body as shown in Fig.-7. 07

OR

- Q.5 (a) Explain deformation of uniform bar section under self weight. 03  
 (b) Determine change in volume of a steel bar of 100 mm dia. and 500 mm length, when it is subjected to axial pull of 50 kN. Take  $E_s = 200 \text{ GPa}$ . & poisson ratio 0.25. 04  
 (c) Calculate change in volume of a rectangular block 525 mm x 230 mm x 115 mm is subjected to load as shown in Fig.-8. Consider poisson ratio 0.25 and  $E$  is  $2 \times 10^5 \text{ N/mm}^2$ . 07

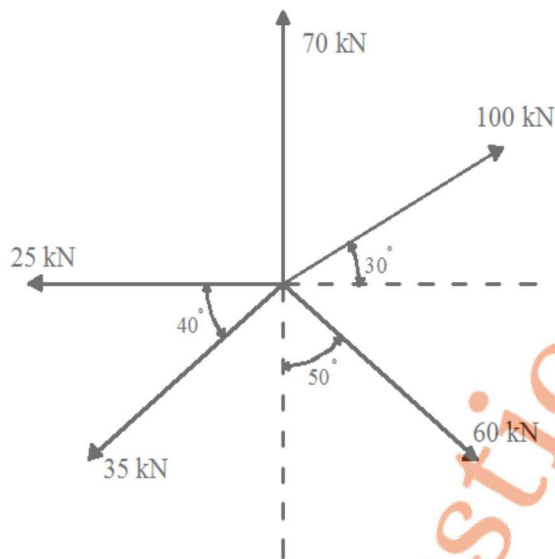


Fig. - 1

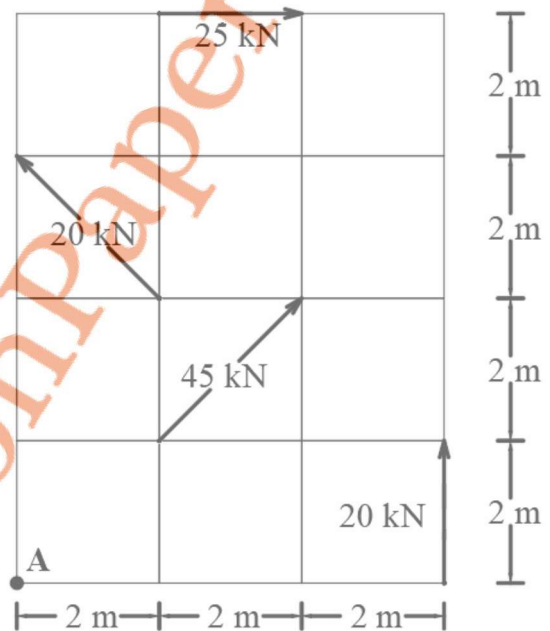


Fig. - 2

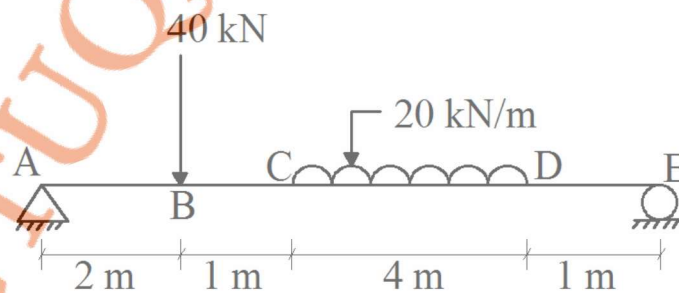


Fig. - 3

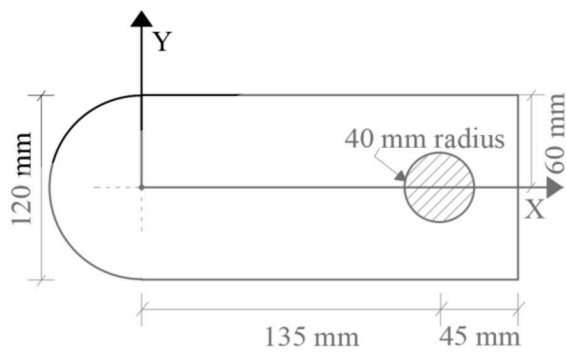


Fig. - 4

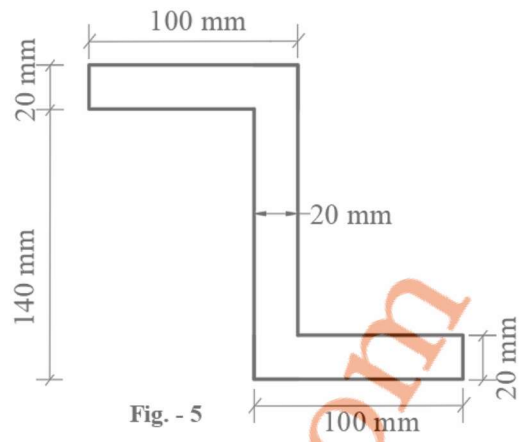


Fig. - 5

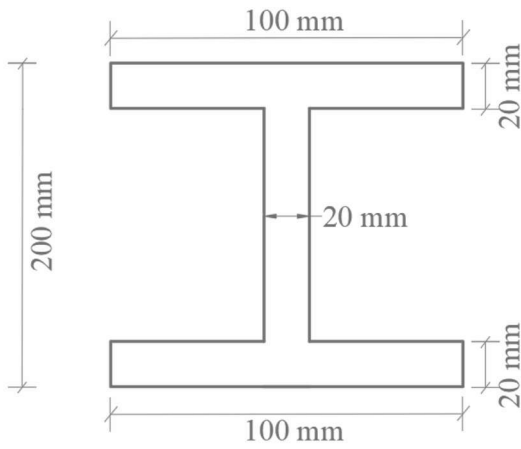


Fig. - 6

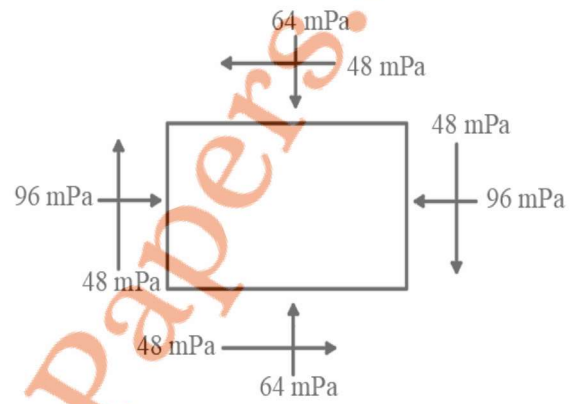


Fig. - 7

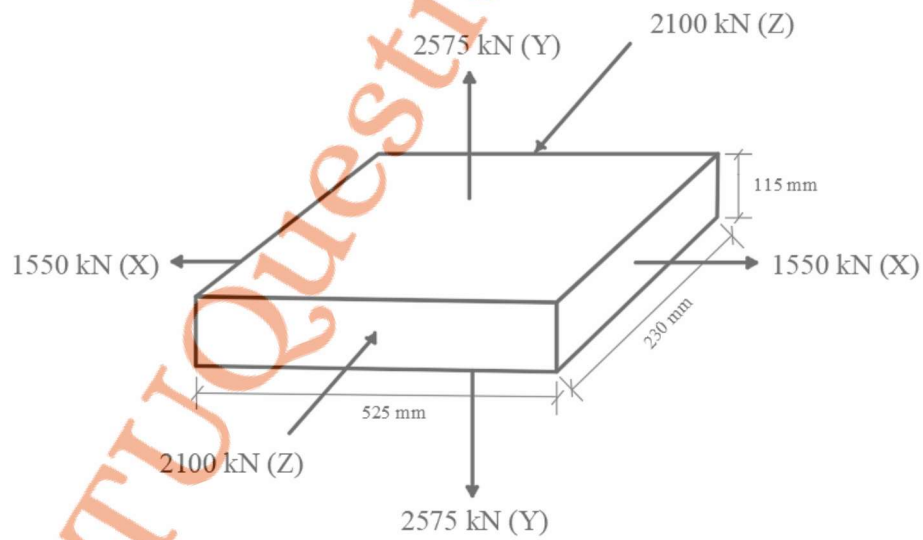


Fig. - 8